The Rocky Mountain Oilfield Testing Center (RMOTC): An Independent Full-Scale Rotary Steerable Systems Testing and Demonstration Facility

A presentation to the
IADD Rotary Steerable Systems Forum
February 15, 2006

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RMOTC Task Manager

Outline

- What is RMOTC?
- Technology Testing at Teapot Dome
- Drilling Testing Capability
- Microhole Drilling
- Flow Assurance Test Loop
- Sharing Data With Partners
- Contact information

What is RMOTC?

The Rocky Mountain Oilfield Testing Center (RMOTC), is an operating oil field focusing on environmentally-balanced energy technologies and alternatives, and is the premiere energy testing and demonstration field in the nation.

Rocky Mountain Oilfield Testing CENTER

RMOTC Provides

Operations and Testing Facilities include:

- Drilling & Service Rigs
- Administrative Services, Engineers, Scientists, & Support Staff
- Support Equipment
- Bio-Treatment Facilities
- Soil Remediation Facilities
- Field Laboratory
- Gas Processing Facilities
- Production Facilities
- Tanks & Pipelines
- Aquaculture & Hydroponic Greenhouse Facilities

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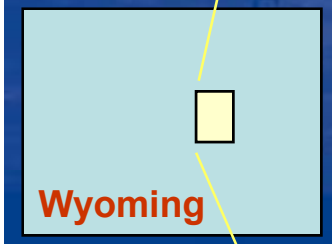
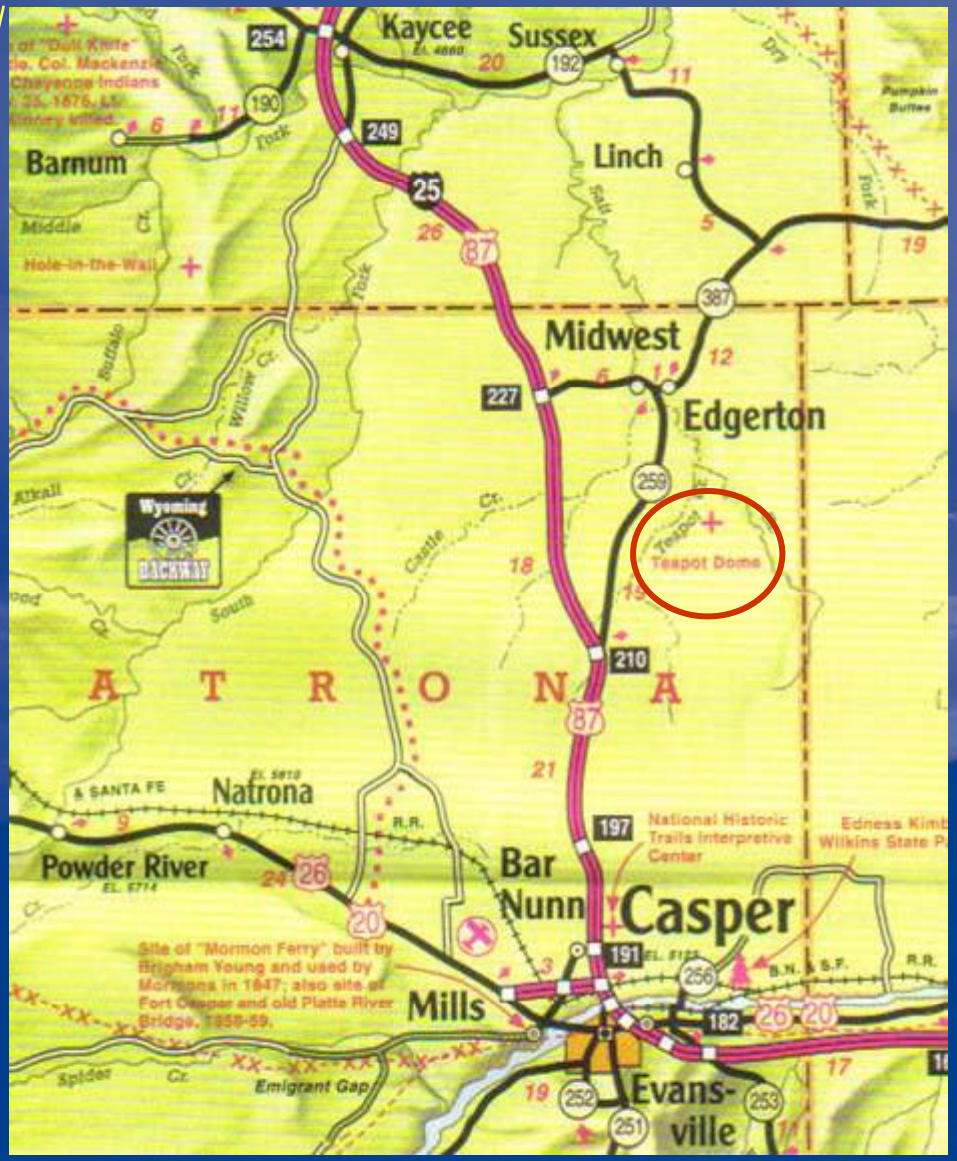
The RMOTC Project Team






Doug


Jim


Judith


Mark


Spike


Ralph


Joe


Vicki


Brian


Lyle

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Unique Location

- Remote, federally-owned and secure site
- 10,000-acre operating oil field
- Full complement of onsite facilities and equipment
- Approximately 1300 well bores; 500 active wells
- Nine producing reservoirs (4 currently active)
- Depths from 250-7000 ft.
- Real world field testing

- Producing, non-producing, and new well drilling opportunities
- Industry experienced specialists
- Varied terrain & weather conditions

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Teapot Dome Geology

Period	Formation		Litho logy	Thick-ness	Depth (feet)	Produc-tive
Quaternary	Kaycee			0-50		
Upper Cretaceous	Steele			195		
		Sussex		30		□
				290	225	
		Shannon		120	515	■
				1355	635	◙
	Niobrara Shale			450	1990	◙
	Carlisle Shale			240	2440	□
	Frontier	1st Wall Creek		160	2680	□
				245	2840	
		2nd Wall Creek		65	3085	■
				175	3150	
		3rd Wall Creek		5	3325	◙
				265	3330	
Lower Cretaceous	Mowry Shale			230	3595	
	Muddy Sandstone			15	3825	◙
	Thermopolis Shale			135	3840	
	Dakota			85	3975	◙
	Lakota			10	4060	◙
Jurassic	Morrison			270	4070	□
	Sundance	Upper		95	4340	
		Lower		150	4435	□
Triassic	Chugwater Group	Crow Mtn		80	4585	
		Alcova LS		20	4665	
		Red Peak		520	4685	□
Permian	Goose Egg			320	5205	□
Pennsylvanian	Tensleep			320	5525	■
	Amsden			160	5845	
Mississippian	Madison			300	6005	
Cambrian through Devonian	Undifferentiated			780	6305	
Pre-Cambrian	Granite				7085	

- Nine oil-bearing intervals
- Four currently producing
  - *Shannon - depth 500'*
  - *Niobrara Shale 2000'*
  - *2nd Wall Creek 3000'*
  - *Tensleep 5500'*
- Granite Basement 7000'
- Range of rock composition & petrophysics
- Clastics and Carbonates

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Reservoir Data

Formation	Shannon	Shales	2nd Wall Ck	Tensleep
OOIP MMBO	144	25	57	4
OGIP BCF	1.4	2.2	45.1	.01
Area, acres	3800	8640	3590	320
Ave Poro.	18 %	n/a	15 %	8 %
Ave Perm.	63 md	n/a	100 md	80 md
Thickness ft.	65	35	30	50
Pressure PSI	25-70	25-250	25-250	2350
Cum. Oil	11.5	4.1	10.3	1.8
Recovery %	8	16	18	45
Cum. Gas	.7	.9	45.1* (inj.)	0
Temp. °F	65	100	125	190
Oil Gravity	29-35	38-42	38	32

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RMOTC Drilling

- Smart Wells
- MWD, LWD, and LWT
- Underbalanced drilling
- Multi-lateral drilling
- Rotary Steerable Systems
- Extended-Reach Drilling
- Micro-hole Drilling Technology
- High pressure jet drillbits
- Expandable tubulars
- Under-reaming

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Previous Rotary Steerable and Related Drilling Testing at RMOTC

- Anadrill/Schlumberger steerable system
- Short-Radius Lateral Drilling – Amoco
- Steerable RWD – Hughes Christensen
- Rotary Steerable System – Smith Drilling
- Bottomhole Kick-off – Halliburton
- Inclined Wellbore – Weatherford
- Short-Radius Lateral – Weatherford
- *Several more in planning stage for 2006*

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RMOTC's New Drilling Rig

The Rocky Mountain Oilfield Testing Center (RMOTC) has expanded its testing capabilities with the newly named RMOTC Rig No. 1, built this year by Crown Energy of Calgary, Alberta, Canada. The new rig replaces the current DOE Rig No. 2, which was in use for 20 years at Naval Petroleum Reserve No. 3 (NPR-3).

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RMOTC Drilling Rig No. 1

- Crown Model Duke 750
- 118 foot high telescoping mast
- 375,000 pounds
- Depths up to 8000 feet
- High-pressure capability to 8000 PSI while rotating
- 900 HP draw-works
- Two tandem reduced-emissions engines
- single engine can also be kept running while the other is shut down for maintenance, all without interrupting drilling operations
- Instrumentation for remote monitoring

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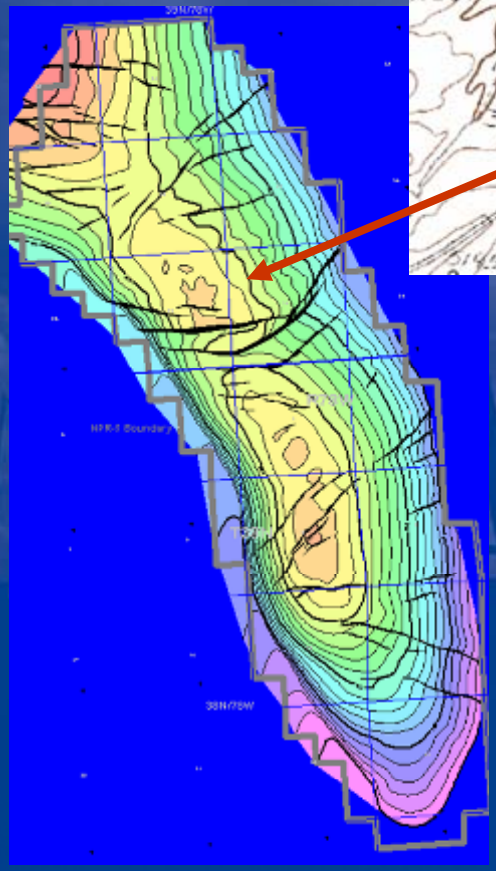
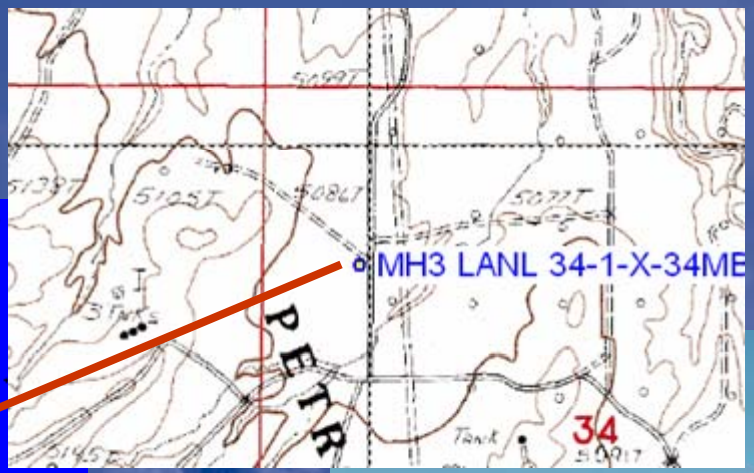
Microhole Drilling





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Los Alamos NATIONAL LABORATORY

Micro-drilling Site at RMOTC: From left to right: the Los Alamos drilling mud cleaning system and the Los Alamos coiled tubing drilling rig. In the foreground is the reserve pit and flush-joint tubing to be run as production casing for a Shannon oil well.

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The Los Alamos coiled tubing drilling rig with 1-in. coiled tubing running through the stuffing-box drilling-mud diverter that conducts high pressure drilling mud to a hydraulic motor and bit on the bottom of the coiled tubing. The hose in the foreground is the flow line that conducts the drilling mud returns from the well annulus to the mud cleaning unit.

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Dennis Tool Company equipment being tested on the Los Alamos coiled tubing micro-drilling rig. From left to right: 1-3/4-in. pilot bit, 2-3/8-in. reamer, and crossover sub to mate equipment to Los Alamos drilling assembly.

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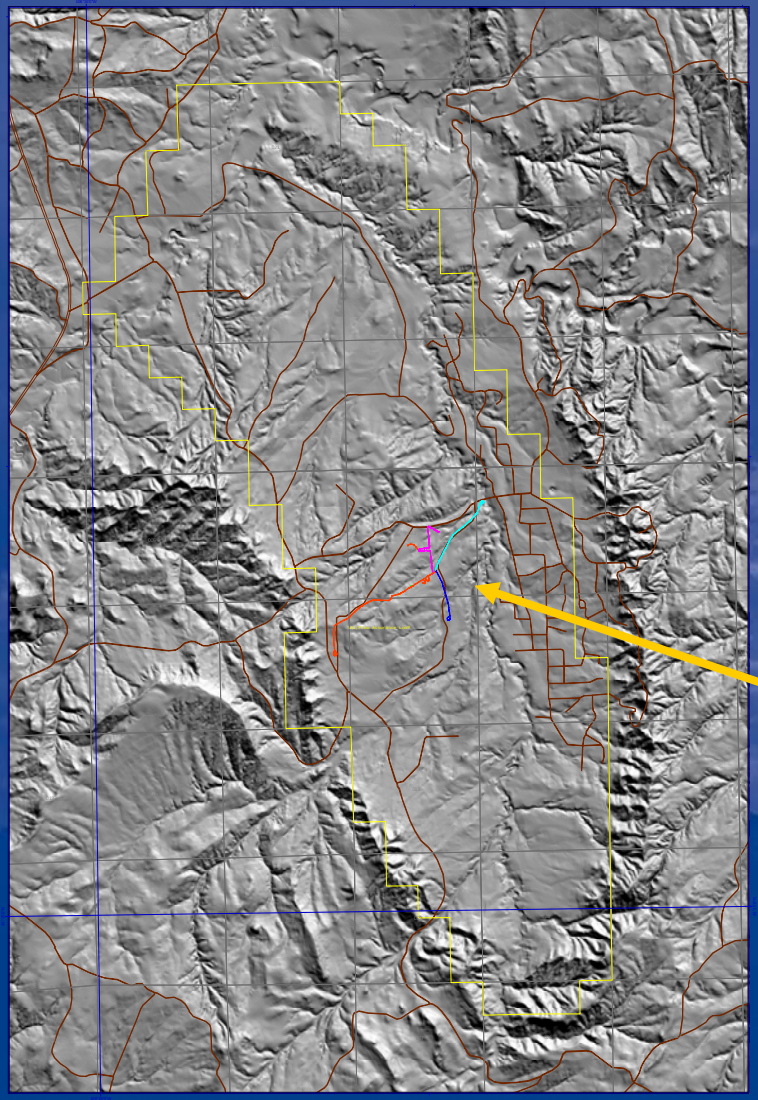
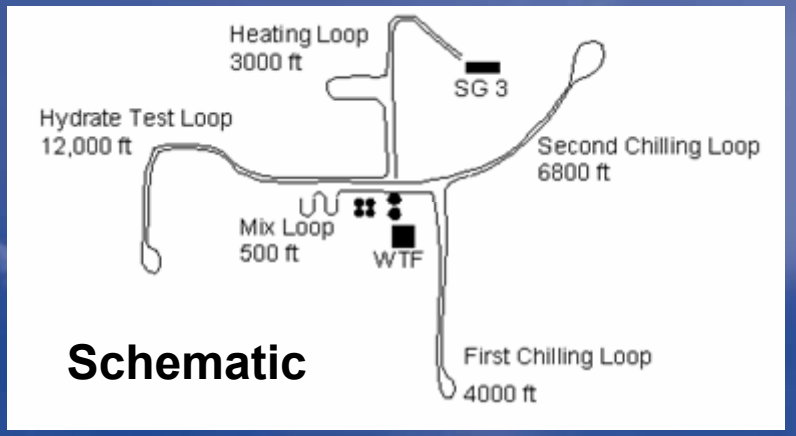
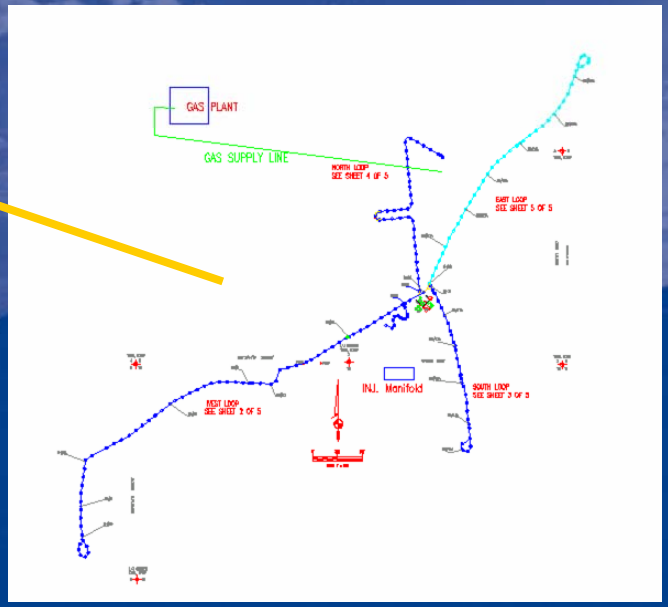
Flow Assurance Test Loop







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Bell Holes and Instrumentation

Concentric Pipe Jacketed Section

- Pressure/temperature gauges
- Test section temperature is sensed by a collateral fiber optics line.
- Nitrogen-filled pressure reference line.
- Dual station gamma ray for hydrate holdup and speed.
- 6 inch, 3600 psi rated, inside of 10 inch, to enable heating and cooling fluid circulation
- 195° F produced water available, >20,000 BWPD

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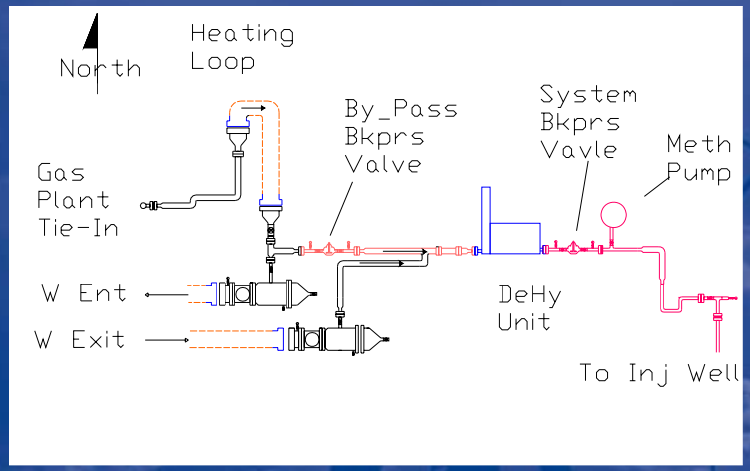
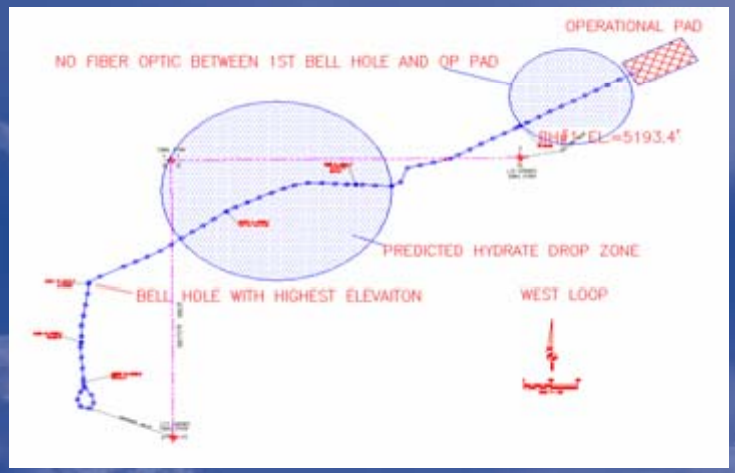
Gas Supply, Dehydrator, and Operational Pad





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Success!

- Methane hydrates formed in the loop as and where predicted.
- Subsequent mitigation tests conducted with a major oil company (still confidential) were also successful at proving their clean-out technology.
- Other major oil companies and consortia are considering future testing using this facility.

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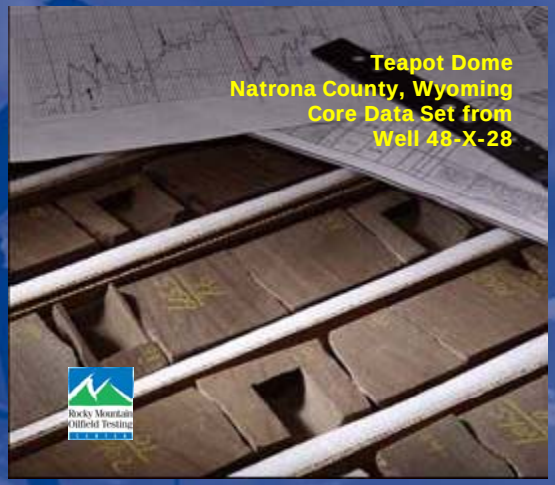
RMOTC Datasets

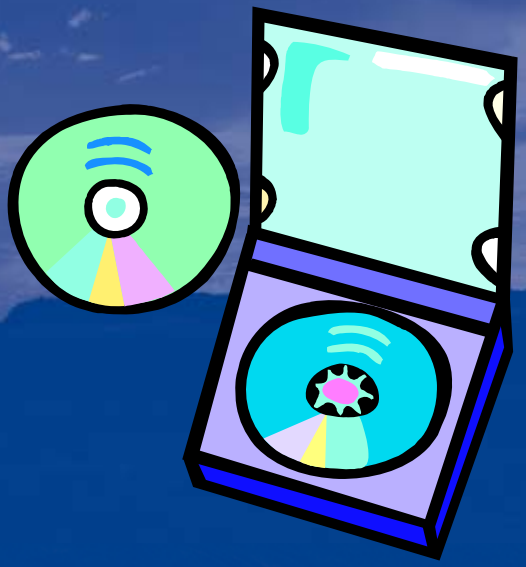
Contact Tom Anderson at
RMOTC, 1-888-599-2200
tom.anderson@rmotc.doe.gov

3D Seismic →

Core Data →



← **Deep Wells (LAS files)**



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